

WHAT IS CLAIMED IS:

1 1. An injection pump assembly in a chemical delivery system for
2 simultaneously delivering reagents into a combinatorial reactor system having
3 multiple reactors, comprising:
4 a plurality of injectors, each injector being in fluid communication
5 with one of the multiple reactors, each injector having
6 a pump with a barrel in which a plunger sealingly moves to
7 ingest, store and discharge a flushing solvent;
8 a pipette assembly for loading, storing, and discharging one
9 or more reagents and the flushing solvent into one of the reactors in the
10 combinatorial reactor system, the pipette assembly comprising
11 a passage
12 a first reservoir for retaining at least some of the
13 reagents;
14 a second reservoir also for retaining at least some of
15 the reagents, the passage being in fluid communication with each reservoir;
16 one or more hollow needles that extend along the
17 passage for selectively delivering a reagent to the first or the second reservoir;
18 a first valve positioned downstream of the first
19 reservoir;
20 a second valve positioned downstream of the second
21 reservoir;
22 so that when each valve is in a closed position, the
23 reagents can be stored in isolation from each other and when each valve is in an
24 open position, the reagents and the flushing solvent may flow along the passage;
25 a 3-way valve positioned between the pump and the pipette
26 assembly, the 3-way valve having
27 a first inlet port that receives the flushing solvent;
28 a second port connected to the pump for ducting the
29 flushing solvent to and from the pump; and
30 a third port connected to the passage for ducting the
31 flushing solvent from the pump; and

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32 an actuator assembly in operable communication with each of the
33 plurality of injectors so that the 3-way valves of each injector may be repositioned
34 in unison, the first valves may be repositioned in unison, and the second valves may
35 be repositioned in unison,
36 thereby delivering precise amounts of the flushing solvent and the reagents
37 in varied or consistent amounts to each reactor in the combinatorial reactor system.

1 2. The injection pump assembly of claim 1 further including:
2 means for energizing the actuator assembly.

1 3. The injection pump assembly of claim 2 wherein the means
2 for energizing the actuator assembly comprises a source of compressed air.

1 4. The injection pump assembly of claim 1 wherein the actuator
2 assembly includes:
3 a 3-way valve linkage system in operable communication with each
4 3-way valve;
5 a second valve linkage system in operable communication with each
6 second valve; and
7 a first valve linkage system which is in operable communication with
8 each first valve.

1 5. The injection pump assembly of claim 4 wherein the 3-way
2 valve linkage system may reposition the 3-way valves through 180°.

1 6. The injection pump assembly of claim 4 wherein the second
2 valve linkage system may reposition the second valves through 90°.

1 7. The injection pump assembly of claim 4 wherein the first
2 valve linkage system may move the first valves through 90°.

1 8. A method for simultaneously delivering reagents into a
2 combinatorial reactor system having multiple reactors, comprising the steps of:

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3 providing a plurality of injectors, each injector being in fluid
4 communication with one of the multiple reactors, each injector having a pump with
5 a plunger that sealingly moves to ingest, store and discharge a flushing solvent;
6 a pipette assembly for loading, storing, and discharging one or more
7 reagents into the combinatorial reactor system, the pipette assembly comprising
8 a passage;
9 first and second reservoirs for retaining at least some
10 of the reagents;
11 one or more hollow needles that extend along the
12 passage for selectively delivering a reagent to the first or the second reservoir, each
13 needle being positionable within the passage so that it may be in fluid
14 communication with the first, the second or with neither reservoir;
15 a first and second valves respectively positioned
16 downstream of the first and second reservoirs;
17 so that when each valve is in a closed position, the
18 reagents can be stored in isolation from each other, and when each valve is in an
19 open position, the reagents may flow along the passage;
20 positioning a 3-way valve between the pump and the pipette
21 assembly;
22 deploying an actuator assembly in operable communication with each
23 of the injectors so that the valves may be repositioned in unison, and
24 delivering precise amounts of the flushing solvent and the reagents
25 in varied or consistent amounts to each reactor in the combinatorial reactor system.

1 9. The method of claim 8, further comprising the steps of:
2 (1) closing all valves except the second port of the 3-way valve;
3 (2) opening the first inlet port of the 3-way valve and operating the
4 pump so that the flushing solvent at least partially fills the barrel of the pump;
5 (3) opening the second valve and delivering a first reagent into the
6 first reservoir through one of the needles;
7 (4) withdrawing the needle so that its delivery end lies upstream of
8 the second valve;

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9 (5) closing the second valve and delivering a second reagent into the
 10 second reservoir through a second needle;
 11 (6) closing the first inlet port of the 3-way valve;
 12 (7) opening the third port of the 3-way valve;
 13 (8) opening the first and second valves; and
 14 (9) expelling the flushing solvent from the pump through the second
 15 and third ports, thereby urging the flushing solvent, the first reagent, and the second
 16 reagent from each injector.

1 10. The method of claim 8, further comprising the step of:
 2 connecting an air cylinder to the actuator assembly so that the
 3 actuator assembly is energized thereby.

1 11. A delivery system for simultaneously delivering chemical
 2 reagents into a combinatorial reactor system having multiple reactors, comprising:
 3 a plurality of injectors, each injector being in fluid communication
 4 with one of the multiple reactors, each injector having
 5 a pump in which a plunger sealingly moves to ingest, store
 6 and discharge a flushing solvent;
 7 a pipette assembly for loading, storing, and discharging one
 8 or more reagents into the combinatorial reactor system, the pipette assembly
 9 comprising
 10 a first reservoir for retaining at least some of the
 11 reagents;
 12 a second reservoir also for retaining at least some of
 13 the reagents;
 14 a hollow needle for selectively delivering a reagent to
 15 the first or the second reservoir, the needle being positionable so that it may be in
 16 fluid communication with the first, the second or with neither reservoir;
 17 a first valve positioned downstream of the first
 18 reservoir;
 19 a second valve positioned downstream of the second
 20 reservoir;

21 so that when each valve is in a closed position, the
 22 reagents can be stored in isolation from each other, and when each valve is in an
 23 open position, the reagents may flow through the pipette assembly;
 24 a 3-way valve located between the pump and the pipette assembly,
 25 the 3-way valve having
 26 a first inlet port that receives the flushing solvent;
 27 a second port connected to the pump; and
 28 a third port connected to the passage; and
 29 an actuator assembly in operable communication with each of the
 30 plurality of injectors so that
 31 the 3-way valves of each injector may be repositioned in
 32 unison,
 33 the first valves may be repositioned in unison independently
 34 of the 3-way valves and the second valves, and
 35 the second valves may be repositioned in unison independently
 36 of the 3-way valves and the first valves,
 37 so that precise amounts of the flushing solvent and the reagents may be
 38 discharged in synchrony in varied or consistent amounts to each reactor in the
 39 combinatorial reactor system.

1 12. The system of claim 11, further comprising:
 2 a cylinder containing a pneumatic fluid operably communicated to the
 3 actuator assembly so that the actuator assembly is motivated thereby.

1 13. The system of claim 12, wherein the fluid comprises air.

1 14. The system of claim 12, wherein the fluid comprises a liquid.
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1 15. The injection pump assembly of claim 7 wherein the actuator
 2 assembly includes:
 3 a 3-way valve linkage system in operable communication with each
 4 3-way valve;

5 a second valve linkage system in operable communication with each
6 second valve; and
7 a first valve linkage system which is in operable communication with
8 each first valve.

1 16. The injection pump assembly of claim 7 wherein the 3-way
2 valve linkage system may reposition the 3-way valves through 180°.

1 17. The injection pump assembly of claim 7 wherein the second
2 valve linkage system may reposition the second valves through 90°.

1 18. The injection pump assembly of claim 7 wherein the first
2 valve linkage system may move the first valves through 90°.